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The Mangrove-tree.

A TREE which seemed to shoot dart-like branches from its top into the ground, where they proceeded to take root and grow, which from its trunk sent forth roots covered with oysters and other shell-fish, and appeared to drop from its branches streams of resin which consolidated into stems, was naturally an object of astonishment to Europeans three hundred years ago, and in many of the narratives of the early voyages to the west coast of Africa and to the West Indies and Brazil are accounts more or less fantastic of the tree which is now called Mangrove, or Rhizophora. Wonderful as were these stories travelers brought home, they are less wonderful than the peculiar adaptation of the Mangrove to maintain its existence under conditions which would destroy it without some such special provisions, and not only to exist, but to spread over large areas and play a well-defined and important part in the economy of nature.

The home of the Mangrove is on the borders of muddy tropical tidal marshes along the margins of shallow salt or brackish streams, lagoons and estuaries. A tree placed in such a position without a solid hold for its roots, and with no dry ground for its seeds to germinate in, would soon disappear unless supplied with special means of overcoming these difficulties. This the Mangrove is able to do by its power to develop aerial roots and by the peculiar structure of the seed, which germinates in the fruit while on the branches. The fruit of the Mangrove is a conical, dry berry containing a single seed with fleshy, closely united seed-leaves and a long thick radicle or stem; this, when the fruit is of full size, begins to grow, and, perforating the point of the fruit, increases in length until it is sometimes a foot long; the lower end, from which the roots are to grow, for the radicle is the first joint of the future trunk, is much heavier and thicker than the other which contains the bud, so that when it attains its full size, and separating from the woody tube which has connected it with the seed-leaves during its growth, and falls to the ground, the root-end sticks fast in the mud, while the young unfolding leaves at the other end are held up above the surface of the water. Without this arrangement for aerial germination the seed dropping into the wet mud would rot, and without the long radicle weighted at the lower end the seedling-plant could not fasten itself in the ground, and so might be washed away and destroyed, or hold its unfolding leaves above the surface of the water.

A tree on an exposed shore, with nothing but soft mud to hold its roots, would soon be overturned by the wind without it was provided with a special anchoring apparatus; and the Mangrove is made secure in its position by aerial roots developed from the stem and branches. The first appear at some distance above the ground, and arching outward descend into the mud at a considerable distance from the stem, while the second descend vertically, and, attaching themselves to the soil, gradually thicken, and finally become stems. By means of these extra roots, the home of oysters and barnacles, the Mangrove is not only firmly held in position, but, by gradually extending the shore-line by a continuous outward development of roots, is able to reclaim solid land from the water. For the mass of roots and stems hold a part of the mud washed in by rising tides, and with the aid of the leaves, which the Mangrove sheds in great numbers every year, gradually consolidate it, and the seedling-plants are provided with soil. In this way a vast territory has been formed along the tropical shores of the world, and for a period longer than the human mind can measure the Mangrove has been fulfilling its mission on the earth and slowly turning water into land.

In the genus Rhizophora three species are recognized by botanists; these are all similar in general appearance and in habit, and only differ in the form of their leaves and in some unimportant floral characters. Two species belong to the Old World, where these trees are found in Asia, Africa, Australia, and on all tropical islands, while the third species, Rhizophora Mangle, is American and an inhabitant, in the United States, of Louisiana, Texas and southern Florida, where it is extremely abundant south of Mosquito Inlet and Tampa Bay, especially on Cape Sable, the shores of Bay Biscayne, and on some of the smaller southern keys, which are occasionally covered by it.

Rhizophora Mangle is a beautiful, round-topped, bushy tree with spreading branches; usually it is only fifteen or twenty feet high, and so entirely occupies the ground with its innumerable roots and stems that no other tree can grow in company with it; sometimes, however, it is found in ground which is not saturated with salt-water, and then it grows up tall and straight to a height of seventy or eighty feet and forms a narrow head and few aerial roots. Such trees as this (see illustration on page 101) are not uncommon in Florida on the shores of some of the small streams flowing into Bay Biscayne and on Cape Sable, and when they are seen from a distance it is difficult to believe that they belong to the same species as the trees which grow on the tide-water banks of the neighboring lagoons. The trunk of a tree of the ordinary form, with its stout anchor roots, appears in the illustration on page 103, which shows the peculiar habit of the tree as it usually appears in Florida, growing under favorable conditions.

The leaves of Rhizophora Mangle are opposite, oval, entire, thick and leathery, dark green and very lustrous, and are enclosed in the bud by long lanceolate stipules which fall as the leaves unfold. The flowers, like those of many tropical plants, are produced continuously through the year, as the Mangrove knows no period of rest; they are yellow, an inch across when fully open, with acute-ribbed calyx-lobes and minute petals covered on the inner surface with long white hairs, and are borne singly on the branches of stout two or three-branched stems produced from the axils of young leaves. The fruit, before the radicle protrudes from its apex, is shaped somewhat like a strawberry

and is an inch or an inch and a half long and of a rusty-brown color.

As a timber-tree the Mangrove is valuable. The wood, which is considerably heavier than water, is dark red-brown in color, very strong and solid, with a handsome satiny surface; it makes excellent fuel, but as long straight trunks are not very common it is not much used as timber; in Florida it is valued for wharf-piles, as the teredo does not relish the tannin it contains and so leaves it alone. All the Mangroves hold in their wood and bark large quantities of tannic acid, and the bark has been used in tanning, but the leather it makes is of inferior quality, and until some method can be found for making it valuable this immense store of tanning material is practically valueless and the Mangrove is left to carry on in peace its quiet, tireless labor.

The two portraits of the Mangrove which appear in this issue are from photographs made on the streams flowing into Bay Biscayne, in Florida, by Mr. James M. Codman, of Brookline, Massachusetts, to whom we are indebted for the opportunity to reproduce them.

The town of Weston, near Boston, has accepted, with gratitude, from Mr. Charles Wells Hubbard the gift of a tract of land along the banks of the Charles River. This tract, says the Boston *Herald*, "comprises about nineteen acres of beautifully diversified meadow and woodland, bordering East Newton Street and the river, and forming part of the picturesque valley through which the Boston and Albany Railroad winds its way between Riverside and Wellesley Farm stations. So much interested have prominent citizens of Weston become in the proposed recommendations of the Metropolitan Park Commission, with regard to the preservation of water frontages near Boston, and so desirable do they regard the permanent preservation of the beauty of the river-banks, that it is understood that, in case the Legislature favorably considers the Commission's report, Mr. Hubbard's example will be followed by further gifts of land, so that ultimately the entire frontage of the Charles in the town of Weston may be dedicated forever to the use and enjoyment of the public. This will not only preserve one of the most beautiful parts of the river, but will go a very long way toward securing the desired action relating to the entire stream."

The Charles River is not only especially beloved by the residents of eastern Massachusetts, but is held in affection by all intelligent Americans, even those who have never seen how singularly charming a stream it is; for it has been celebrated in prose and verse to a greater extent than any other American river, not excepting even the Hudson. It is the one stream in America whose name has a classic flavor as connected with the lives and imaginings of many writers whose works are sure of permanent life. Therefore, we may accept, from the point of view of poetic sentiment, as well as the point of view of mere beauty, the words of the writer in the Boston *Herald*, when he adds: "The Charles River has the same value to the people of Boston and its metropolitan surroundings that the upper river Thames bears to the inhabitants of London. It is a great factor in the recreation of the people. Particularly important in this respect is the charming stretch between Newton Lower Falls and Waltham. Here alone over 800 pleasure craft of various kinds are kept. This proposed gift of land on the Charles, aggregating something between 200 and 300 acres, is but one instance of the prospect of valuable gifts of the kind in other parts of the metropolitan district, in case the recommendations of the Metropolitan Park Commission are adopted. The prospect of such beneficent action on the part of public-spirited citizens should prove one of the most powerful arguments for favorable action by the Legislature in relation to the work of the commission." Those who have followed the work of the Boston park commission during recent years, who know how broadly, yet carefully, its steps have been considered and then taken, and who have seen the tracts, lying in various directions from the centre of population, which have already been purchased or condemned for future purchase, realize, indeed, that in some respects the government of the chief city of New England may be held up as an example for imitation to the governments of all other American towns. The Metropolitan commission was appointed to consider the needs of the community living in and outside the municipal limits of Boston. If the recommendations, which we have already discussed, are adopted, then the New England metropolis will indeed be fortunate.

The Value of Marsh Lands.

PROFESSOR SHALER, in an interesting paper published in the annual report of the Massachusetts Board of Agriculture, calls attention to the value of the extensive marshes of that state, which should really be esteemed a valuable possession rather than a melancholy encumbrance. While our country was but thinly inhabited, such land was allowed to go to waste, but, as population increases, public attention is beginning to be called to the necessity of utilizing more of the area of the state for cultivation, and these once disregarded fields are beginning to be regarded as objects of economic importance. In Holland the value of its polder land is fully appreciated, and large sums have been spent in draining such marshes as are to be seen along the New England coast for miles. It is estimated that there may be ninety thousand acres of marine marsh in addition to 150,000 acres of fresh meadow in Massachusetts alone, most of which could be made to pay a good income upon the amount necessary to expend for reclamation. The process of making peat-bogs serviceable for agriculture in Europe has been conducted in the slow and unenterprising fashion that characterizes the movements of the older world. It has been left for New England to find out the way in which cranberries can be raised with prompt and satisfactory results upon the lightly sanded surface of a peat-bog, which Professor Shaler considers one of the great discoveries of modern agriculture and a proof of the inventive talent of the Yankee farmer.

When it is possible to secure a sufficient supply of fresh water to inundate these bogs, in order to protect the flowers and fruit from frosts and from insects, this industry has been so successful that it is said to return a larger percentage on the capital invested than any other form of tillage which has been practiced in the northern states of this union. Unfortunately the area in Massachusetts where the Cranberry can be cultivated is very limited, as it cannot be raised profitably far from the sea-coast nor very far north of Boston. The berry is, to be sure, raised even as far north as the St. Croix River in Maine, but untimely severity of the weather often endangers the crop in that more rigorous climate. The marsh is prepared for planting by covering the surface of the peat, after stripping off its upper coat of vegetation, with sand, preferably from the sea-shore, and inserting therein the plants to such a depth that their roots can feed upon the underlying vegetable matter. Stimulated by the moisture and protected by flooding in case of early frost, this late-ripening berry brings in valuable returns. There are many anxious moments as the critical period arrives, and only the eye of the master has the requisite vigilance to know just when the door of waters must be unlocked to prevent an unlucky nipping of the blushing fruit. Also, when the picking time comes, a whole neighborhood has to be turned into the meadow to secure the ruby harvest with requisite promptness.

When it is considered that a million dollars' worth of strawberries and cranberries are raised in one year in Massachusetts alone, the value of land where both these crops can be supplied with the requisite moisture may more seriously be estimated. For, not only are these bogs valuable for the Cranberry, but it is certain that with much less expense they can be made available for the crops of the market gardener. For these crops the costly arrangements for flooding the land will not be necessary, nor will pure sand only be required, and any arenaceous soil at hand can be substituted. The great difficulty of plowing such land can be avoided by using traction plows, drawn by engines placed on the firm ground, or by spading the whole surface. By thorough ditching and draining the water-level can be lowered until the peat attains sufficient firmness to support draught animals, and should plowing be impossible even then, from the frequency of the ditches, the light character of the soil would make hand-cultivation easy. On such land, strawberries, which delight in

moisture, can be grown to great advantage, and the needs of the soil can be met with mineral fertilizers, which can be applied with comparative accuracy. The best market ground in Florida is a mixture of peaty matter and pure sand, and there the mineral manures are applied as experience dictates with good results. We have much to do in the way of experiment in the management of such lands, but there is no doubt that when the shrewdness of the American farmer is once brought to bear intelligently upon the problem, the peat-bogs can be made as valuable for gardens here as they are in the low countries, and with less trouble and delay.

The same is true of the salt-marshes that abound along our Atlantic border, which result from the gradual filling up of small bays and arms of the sea by marine grasses, which afford a lodging-place for sediments borne to the spot by the action of the tide, or washed down from the shore. This process, which goes on constantly, can be observed in any small harbor where the Eel Grass flourishes and gradually closes up the channel. These sea-marshes, when reclaimed, show a fertility which is surprising from its apparent inexhaustibility. The soil, unlike that of the peat-bogs which requires constant application of chemicals to correct the excess of vegetable matter existing in it, seems rich in material for the growth of economic plants, and affords enormous crops of grass and grain, year after year, without other fertilization than the occasional renewal of the surface by deep plowing. All garden crops that do not demand especially dry soil grow on such land with great freedom, and a flower-garden on such soil is a delight to the gardener, for it never needs watering. Irises and Lilies of all kinds do especially well in the rich, damp mold, and perennials grow most luxuriantly.

It requires several years to conquer a salt-marsh, even after it is drained of salt-water and provided with an exit for the fresh, for the fibrous peat, made of the tangled remains of the grasses of hundreds of years, is slow to decay, and the salt still at times encrusts the surface and has to be destroyed by plowing. Still, under favorable conditions, the ground after three years can be brought into excellent condition. In the beginning, root crops are the most desirable, and later, the soil is fit for grasses, of which Red-top affords the best returns. In Marshfield, Massachusetts, an area of about fifteen hundred acres was diked off from the sea some years ago, and though local dissensions have delayed the work, yet the results have shown the value of the experiment—fields which once yielded only a scanty crop of marsh grass now giving a generous harvest of hay and root crops.

As a feature in landscape-gardening a bit of meadow-land is most valuable. The drains can take the form of a winding stream. Osier Willows can readily be made to grow even along a salt-marsh, by affording them a bed of sand to spread their roots in, and shrubs can be tastefully grouped in the curves of the miniature river, while flowers that love moisture can be effectively disposed in masses. The varying tints of the level stretches of turf are full of beauty, and the smooth, flat expanse has the charm which always attaches to an open, grassy space well girt with trees. If the meadow be fresh, all sorts of planting is possible to enhance and emphasize its characteristic beauty, and even if it be salt, there are many things that can be made to grow along its borders, and its own level will lead the eye away and give a sense of openness and distance that are of great importance in any landscape.

Thus, both for use and beauty, marsh lands are to be prized and made available for profit and delight. The peculiar struggle involved in their reclamation has always a singular attraction for him who undertakes the business, for no man who joins battle with a meadow is content to come out second-best, no matter what victory may cost him. Hence ensues a prolonged encounter, in which the man ultimately finds profit and gains valuable experience. That the experiment will pay, the experience of Europe amply proves, for the best lands of Great Britain, northern Germany and Holland, and much of those of excellent quality in southern Europe, were, a thousand years ago, in exactly the same state as the undrained territories of this country.

A Rare Fern.

THIRTEEN miles from Bowling Green, Kentucky, I found, September 10, 1892, a specimen of the rather rare Fern, Bradley's Spleenwort (Asplenium Bradleyi). About a quarter of a mile from Young's Ferry, Warren County, a hill extends for a mile or more, crowned by perpendicular sandstone cliffs. On the side of the bluff sloping from the river, shaded and protected from the winds by the overhanging cliffs, the Mound Builders or Indians evidently made their homes. In some places the cliff is almost a perpendicular wall of sandstone, at others the rock is worn and broken into picturesque ravines and grottoes. Into one cleft an immense stone has fallen and lodged between the walls, resembling in miniature the well-known Flume of the White Mountains. In other clefts are grotto-like places resembling parts of Mammoth Cave. Over and above these caves, through shrubs and Ferns, could be caught glimpses of the sky.

The soil along the river at this point and in the adjoining counties is rich in asphaltum. At the foot of the hill is a grove of magnificent Beeches. The hill itself is covered with a stunted growth of Sassafras and other trees and a tangle of Blackberries. On the sand-stone cliff and ridge is a growth of Laurel (Kalmia latifolia), Huckleberries (Vaccinium arboreum) and V. vacillans) and Sourwood (Oxydendrun arboreum). On the ridge I found the grass Erianthus alopecuroides and the still rarer White Gentian (Gentiana ochroleuca). The view from the top of the ridge is fine in the extreme, being a panorama of the knobs and valleys for miles around, and overlooking three counties. On the cliff above and below are masses of Ferns drooping in the greatest profusion, the smaller ones growing in mats in the moss on the rocks. The latter were common Polypody (Polypodium vulgare), Walking-leaf Fern (Camptosorus rhysophyllus), called by the country people Wall-link, Maiden-hair Spleenroot (Asplenium trichomanes), and with them Liverworts and Partridge-berry.

The larger Ferns, some of them over three feet in height, were Aspidium spinulosum, var. intermedium, A. marginale and a few of the Cinnamon Flowering Fern (Osmunda cinnamomea). But the gem of all in point of interest, if not of beauty, was the one specimen of Asplenium Bradleyi. Here in a crevice of the moist sandstone, shaded and protected from the wind, grew this rare Fern, first found in 1872 in the Cumberland Mountains, near Cold Creek, East Tennessee, by Professor F. H. Bradley, and described by Professor Eaton soon after. The mature fronds are seven and a half by one and a half inches, linear oblong, pinnate, pinnæ numerous, oblong ovate, the largest pinnatifid, fruit-dots short, stipe black, tufted, the lower half of rachis black also; root-stock very short and covered with black scales.

Professor Williamson, in his *Kentucky Ferns*, says that though he botanized throughout the entire state where A. Bradleyi was likely to be, he failed to find it. Professor Hussey, in his report, wrote that he found one specimen in Edmonson County, near Green River and Mammoth Cave, and, though he searched a hundred similar localities, failed to find another. The only other report of it I have heard is by Mr. C. C. Hoskins, in 1876, from near Big Clifty, Grayson County. A specimen is now in the herbarium of the University of Indiana, but where this was gathered I do not know. Professor Eaton, in his *Ferns of North America*, mentions that a single specimen of a less-developed form has been collected near Newburgh, New York; also, that Williamson found a plant in Estill and Rockcastle Counties, Kentucky. This must have been since the publication of his *Kentucky Ferns*. He adds that it will probably prove to be less rare than is supposed, and to have a wider range, since the Newburgh plant is manifestly identical with the plant found in Kentucky. However, this work was published in 1880, and few, if any, specimens have been reported, at least to my knowledge, since that time. I should very much like to know whether there are other botanists who have found this Fern during recent years, and if it is still considered a comparatively rare species.

Professor Hussey thus described the place where he found it, in Edmonson County, Kentucky: "Under the overhanging sandstone, sheltered from the sun and sweeping winds, are sometimes spaces of vast extent, where the aborigines had their homes, as evinced by the numerous fragments of flint, and by the mortar-holes in the detached masses of sand-rock. On one of these sandstone cliffs I found the Asplenium Bradleyi, and, recognizing it as new, sent it to a botanical correspondent, from whom I learned it had already been described by Professor Eaton. . . . Under a moist overhanging rock, a few hundred yards distant, was found the Trichomanes radicans, shut out from direct sunlight, and where there was constant dampness."

This is a perfect description of this point near Green River, where I found the plant of A. Bradleyi, and not three fee away, under an overhanging rock, grew the rare Trichomanes radicans. Flint fragments were picked up and a large mortar-stone stood near by, in front of the grotto. The rock was about five feet in diameter, two feet high; near one side was a mortar-hole about five inches in diameter and about ten inches deep.

I have since visited the Old Indian Fort, a natural fort, seven miles from this point, and other similar cliffs in this locality, but have failed to find another plant of this Fern.

Bowling Green, Ky. *S. F. Price.*

Plant Notes.

Hybrid Brier Roses.

A RECENT issue of *The Garden* contains a colored plate of a group of the hybrid Brier Roses shown in London last year at the metropolitan exhibition of the National Rose Society by the raiser, Lord Penzance, an enthusiastic rosarian and liberal supporter of the society. These hybrids are obtained by crossing the Sweet-brier with various Hybrid Perpetual Roses, chiefly Alfred Colomb, Dr. Sewell and Paul Neyron. The new race is sweet-scented, with foliage as fragrant as that of the Sweet-brier. The color of the flowers varies, however, from light pink to scarlet, and in the *Rosarian's Year Book*, Lord Penzance reports that "as many as four or five of the seedling Sweet-briers which have hitherto flowered have now turned out to be perpetuals, blooming a second time tin the autumn and blooming then freely. During the autumn of 1891, indeed, in spite of the heavy rains they have gone on blooming right through the month of October, and they bloom, like their seed parent, in clusters. An additional charm, and in my estimation a great charm, is to be found in the fact that these flowers have a very delicious scent—a scent quite independent and different from that of the foliage." From an article by a correspondent of *The Garden* which accompanies the plate of these charming flowers the following account is condensed:

Many lovers of the Rose will call to remembrance the collection of hybrids of the Sweet-brier and other types Lord Penzance sent to one of the meetings of the Royal Horticultural Society in June, 1891, and later to the Rose show held at the Royal Aquarium. They illustrated in a remarkable degree the possibilities of cross-breeding in Roses, in which work his lordship has proved eminently successful.

In a paper contributed to the *Rosarian's Year Book* for 1891, Lord Penzance asks, How do these modern Hybrid Perpetuals comport themselves in the garden? He answers his own question, by saying, "We all know how hard it is to make a lovely object out of a standard Rose, and whenever this is done it is achieved only by a very careful and skillful use of the pruning-knife. But, take the dwarfs. Do they form themselves into what used to be known as a Rose-bush; or are they not given to exhibit a straggling, unequal growth, one or two shoots breaking up from the crown or the lower part of the plant and robbing the life from the rest? If cut back hard in the spring the plants become a stumpy, somewhat insignificant and not a very captivating object. If subjected to what the French call the 'taille longue,' they are apt to become leggy and shabby in the lower branches. Here, again, there is no doubt but that a good deal may be done by skillful pruning, but the growth of the plant does not lend itself readily and naturally to the formation of an even head or symmetrical bush." It must be admitted there is much truth in the foregoing remarks.

Lord Penzance is of opinion that the gift of autumn-flowering of the Hybrid Perpetuals comes from having been crossed with what he calls the Eastern Rose—the Rose de Bengale of the French. The comparatively scanty bloom of many of the Hybrid Perpetuals, and the contrast between the old summer Roses and the modern Hybrid Perpetuals are very striking. The old summer-flowering Roses are covered with bloom in their season. I saw a striking instance of this in an old garden at Enfield during the past summer. A path, arched with wire trellises, had been covered years ago with the old-fashioned summer Roses, and at the time I saw them they were in grand bloom; indeed, in such happy plenteousness, as to form a floral sight worth going miles to see, but the gardener, knowing the fleeting character of the Rose-bloom, had wisely planted, among the Roses, Clematises and other late summer-flowering subjects to carry on the floral succession until the autumn. Lord Penzance points out that the class of Roses known as Hybrid Chinas and Hybrid Bourbons, none of which ever bloom a second time in autumn, put forth a sheet of bloom in every part of them during the summer with a profusion which it would be difficult to name half-a-dozen Hybrid Perpetuals capable of emulating. Two more well-known defects in the Hybrid Perpetuals are mentioned. They are destitute of fragrance, and "many, if not most of them, are short-lived." It was the existence of these defects in our most popular class of Roses which induced Lord Penzance to try if something better could not be produced by working upon new lines. Recognizing the fact that the races or families of the Rose are capable of combining by cross-fertilization, his lordship entered upon a line of action of his own with the object of securing a new Rose which might be free from some of the existing defects. The Sweet-brier was selected as the natural basis of a new race. In the first place, it is indigenous to the soil and climate; it is proof against the most vicious attacks of our English winters; it is superior to the weakness of mildew, and as little subject to the troubles of the Rose as any other species. It is a prolific seed-bearer, and "more certain to bear fruit when fertilized with pollen of other Roses than any Rose or class of Roses that in my limited experience has presented itself."

Some interesting facts are noted. The seedlings obtained by impregnating the Sweet-brier with foreign pollen had a remarkable strength of root and growth, and struck readily from cuttings. The sweet-scented foliage of the Sweet-brier was also produced. A complete cross was obtained between the Sweet-brier and the Persian Yellow, the bloom larger than that of the Sweet-brier, pale yellow in color, and the foliage fully as fragrant, if not more so. The Austrian Copper, crossed on to the Sweet-brier, produced a seedling, the bloom not quite so deep in its color as that of the pollen parent, yet a close copy of the original, with the sweet scent of the Brier diffused in its foliage. The pollen of the Hybrid Perpetuals, the Hybrid Bourbons and the Hybrid Chinas, put upon the Sweet-brier, produced distinct crosses—distinct in the sense that the wood, foliage, habit of growth and the thorn are not those of the Sweet-brier.

"Among hundreds of Sweet-brier seedlings," says Lord Penzance, "which are evidently crosses, I have had only one that did not retain the sweet foliage of the seed parent, and as to this one I cannot help thinking there must be some mistake as to its parentage." All attempts to cross the Sweet-brier upon the Hybrid Perpetual have failed to produce scented foliage, but the seedlings so obtained have been small, and Lord Penzance is not by any means hopeless of attaining this result.

So far the blooms of the Sweet-brier seedlings show but little tendency to doubleness. Lord Penzance states that none of them as yet have given him more than two complete rows of petals. It is his desire to secure a greater degree of doubleness, and he hopes to succeed in another generation or two of seedlings. With this end in view, it is his intention to cross them again with the pollen of Hybrid Perpetuals, Hybrid Chinas and Hybrid Bourbons. Other crosses have engaged, and still are engaging, the attention of Lord Penzance, such as the Moss Rose, Cellini, with the Musk Rose, Fringed Musk, which he has secured; the joint characteristics of the progeny are unmistakable. Monsieur Crépin, the distinguished authority on the botany of the Rose, pronounced it to be a distinct hybrid.

One difficulty in the way of the cross-fertilization of Roses is to procure "the pollen required at the right moment. The time at which, and during which, the stigmas of the flower to be operated upon are mature and fitly receptive is very uncertain and of short duration. The same thing is true of the anthers, and the liberation of pollen, and this makes an opposite combination between the stigmas of one race and the pollen of another no easy task." But in the course of his operations Lord Penzance has discovered that the pollen of the Rose can be kept in full vitality if preserved from all moisture or damp for many weeks—in short, from one end to the other of the hybridizing season—and in his experience the preserved pollen may actually produce a larger proportion of seed than the pollen fresh from the flower. Not that it is to be understood that preserving pollen adds to its fertilizing power, but that "it can be applied to the stigma of the seed-bearer in much fuller quantity and much more handily and adroitly than can be done with the fresh. When the pollen bursts from the anthers in the first instance it very often breaks forth in small quantity only, and the supply of it is at times apt to fall short in the midst of an operation." Then ripe pollen is not always obtainable when the flower to be dealt with is exactly fit for the work, and there is a temptation to take the pollen before it is fully ripe.

It must not be supposed all the crosses made by Lord Penzance have succeeded. He has failed with the Boursault and Microphylla types; also with Rosa Sinica and the Macartney Rose, but there is the right ring in the resolve with which his

lordship concludes his interesting and instructive paper when he says, "I have hitherto been vanquished in these attempts, but I shall not give them up until I have received a good many more rebuffs."

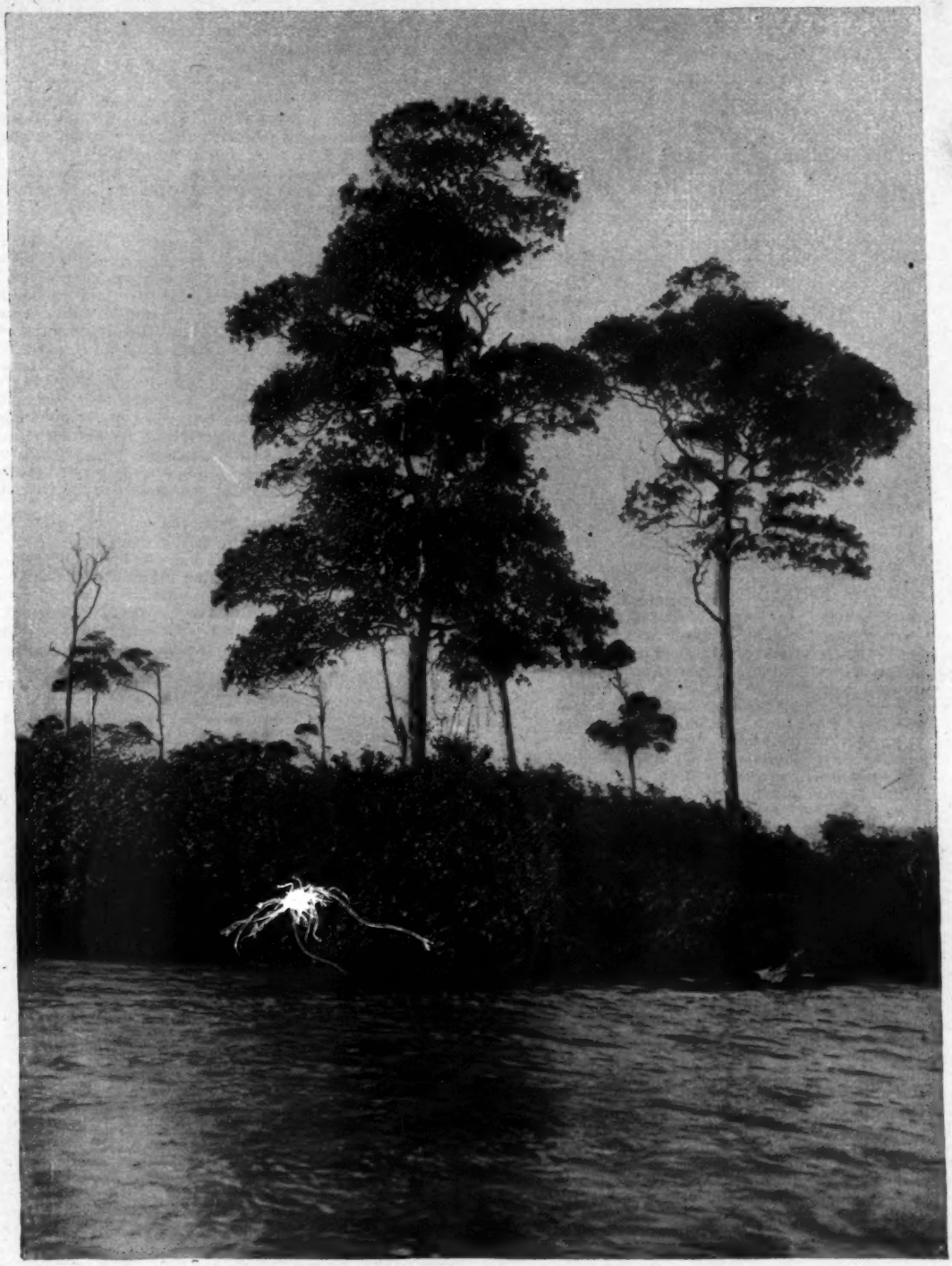

Fig. 17.—The Mangrove-tree (Rhizophora Mangle) in Florida.—See page 97.

Foreign Correspondence.

A Famous English Nursery.

ONE of the most famous English nurseries is that of Messrs. Sutton & Sons, who, with the Palmers, of biscuit fame, are the ruling powers in the quaint town of Reading by the banks of the river Thames. American visitors to England who are interested in horticulture find much to interest them in the fine seed warehouses and trial-grounds. Mr. Martin Hope Sutton is the senior member of the firm. The father of Mr. Sutton was a miller and corn merchant and was greatly averse to adding garden seeds to the business. Soon after leaving school in 1832 the present Mr. Sutton undertook a three days' walk to see some remarkable Tulips at Slough and Brentford,

and then, via Staines and Sunninghill, to see the celebrated nurseries of Knap Hill and Woking. He met there Mr. Low and Mr. Waterer and walked back in the night some twenty miles to be at his desk at the usual time in the morning. In 1837 a nursery was established at Reading. The nursery business was ultimately abandoned, and plants are now grown solely for seed.

Probably the first impulse to the cultivation of field as well as garden seeds was made on the occasion of the great Irish famine, when immense quantities of seed were required by the Government and large orders were executed. The warehouses and offices of the firm are unusually fine and the buildings represent, inclusive of the land upon which they are erected, an outlay of £100,000. The imposing front of this establishment is one of the conspicuous features in the town. The arrangements for the quick delivery of orders and replies to the daily correspondence are perfect, while the welfare of the employés is carefully considered. On the King's Road in a large block of buildings are a restaurant, lecture hall, with a sitting accommodation for one thousand persons, and reading-rooms. A café, designed especially for the workmen of the firm, is opposite to the Abbey Square, and contains bedrooms, dining and club rooms. In the seed or trial grounds there are broad acres of vegetables, annuals and other flowers for trial.

Several houses are given over to the Chinese Primula and Persian Cyclamen. This firm has done much to improve the Chinese Primula, of which they have the latest and choicest varieties. These flowers can now be had for about six months in the year by successive sowings, and they furnish an abundance of bloom at a dull period of the year. It is interesting to compare the varieties of the present day with the first Primulas ever raised and with the typical plant sent over from central China to England in the year 1821, and reintroduced recently. I saw plants of this wilding in bloom here, differing greatly from the superb flowers with which these houses are filled. The type has lilac flowers; the leaves are small, but vary considerably in size and also in the color of the stems, some being red and others white. The blue Primula is the result of selection and recrossing, during many years, of flowers showing shades of lilac. The latest successes with this variety are seen in the plant-houses at Reading. While the blue Primula of the present cannot be described as an ideal blue, the color is improving each year, the magenta tone being less evident. Reading Blue is a superb flower, broad, large and of intense color, with a compact truss carried well above the base of sturdy leafage. There is a double counterpart to this fine form raised from a single variety. The flower is quite double, but less so than the Marchioness of Exeter, and approaches more in character the old Double White Primula, as it was called in England. In spite of the many splendid recent acquisitions, the old Double White Primula is still more largely grown for the English markets than almost any other greenhouse plant. It blooms freely, the flowers are of the purest white and the plant is easy to grow. One market-grower in the vicinity of London has several houses filled with this variety. The double Primula is just becoming a favorite in England and its popularity is likely to increase. At Reading this section is well represented. A double blue is one of the most pleasing varieties, and there are, besides, double carmine, double white, fern-leaved, double rose, a very pleasing shade of color, and double scarlet, a brilliant scarlet and exceptionally free in blooming.

Additions to the prevailing list of colors are continually being made, and in time these may be surpassed by even such fine single varieties as Giant White, Pearl, Giant Crimson, Purity, Reading Scarlet, Ruby King and Reading Pink. The change in habit has been almost as great as that in the flower. Years ago the Chinese Primula, like the Persian Cyclamen, was scraggy and leggy, the leaf long and lacking in robustness. This is all changed now. The leaves of the Primula of to-day are vigorous and make a splendid base from which, on a sturdy stem, the head of flowers rises, borne in a compact shapely truss. A mass of the Giant White presents an even surface, each flower standing out boldly. A section likely to become popular is the moss curl-leaved, the foliage of which is very pretty and curled up like moss. I also noticed a variety named Terra Cotta, which is quite distinct. The flowers are single, finely shaped, terra cotta in color, shaded with salmon.

The Persian Cyclamens figure largely at Reading, and this fine winter flower was at its best at the time of my visit. A great advance has been made in the improvement of these plants in the matter of sturdy habit and decided color of flowers. There are no dingy magenta shades in the strain at Reading, a color that spoils utterly many otherwise fine varieties. Sutton's White Butterfly is a superb kind; the flowers are very large and of the purest white. This is a useful variety for cutting. The same high standard is reached in Giant Crimson, White, Rose and Vulcan, the latter of a rich crimson tone. Splendid plants, a mass of leafage, are the results of one year's cultivation, the seed being sown early in the year and the plants flowering the following winter.

What has been written respecting the cultivation and improvement of these two great classes of indoor plants is true also of Gloxinias, Tuberous Begonias and many other florists' plants grown by this firm. In the summer months the extensive trials of annual flowers are interesting and important features of the work of the firm. Last year broad beds were filled with the new annual introduced by them, named Nemesia strumosa Suttoni. This is likely to prove a great favorite. The seed grows readily, and a bed of plants produces flowers in great variety of color, the shades of orange from sulphur to deep crimson making a rich effect. It belongs to the Scrophulariaceæ and was introduced about 1887 from central Africa. The plants are very free-blooming, each of the flower spikes, which rise nearly a foot in height, bearing many flowers, which measure about an inch across individually. The same cultivation that applies to half-hardy annuals is suitable for Nemesia.

An important department of the firm's work is that of growing vegetables for trial. All visitors to English horticultural shows are acquainted with the splendid produce exhibited by Messrs. Sutton & Sons. The firm makes a specialty of Potatoes, and in all their trials have carefully kept in view the importance of securing kinds that resist disease. The well-known Magnum Bonum variety was sent out by them. The firm has seed farms in many counties of England and also in Scotland, and they are thus able to furnish tubers from different conditions of climate and from various soils. They also give this same special attention to the cultivation of Peas, and no less than four hundred trials of the leading kinds in cultivation are made each year. Ringleader was distributed by this firm, and many other excellent varieties. They have now a large list of unnamed seedlings on trial, and these will undergo the selecting process until they are ready for distribution. Cabbage, Turnips, Mangel Wurzel and other farm crops are grown largely and subject to the same painstaking care as in the case of the Potato and Pea.

Reading is about thirty miles from London, and express trains run at frequent intervals to this busy country town, which has much of interest to antiquarians. A pleasant and profitable day's outing is offered in a walk through the quaint streets of the town and through the spacious grounds and houses of Messrs. Sutton & Sons, especially in the summer season, when the various trials of flowers and vegetables are seen to the best advantage.

England. *V. C.*

Cultural Department.

Orchids for Window Plants.

THERE is no doubt that even a larger list of Orchids than that given by Mr. Manda in a recent number of Garden and Forest can be cultivated and flowered successfully in window-gardens. Those able cultivators, the women who

manage so many home plants, often grow plants which are more difficult to cultivate. A few Orchids in the amateur's collection need not displace old favorites. They usually require just enough management to make them interesting, and in most places are still unique enough to excite general attention. It is unfortunate in many respects that there has been so much artificial glamour thrown about Orchids, as it has greatly impeded their distribution among small growers who are apt to think of them as plants beyond their means or skill. The actual fact is that many of the free-flowering kinds are easily managed and can be bought at a moderate price. A newspaper description of a dinner commonly includes a satin and point-lace table-cover, and the same authority rarely fixes the value of an Orchid at less than a thousand dollars. While every one discounts the first story there is a tendency to accept the latter, and amateurs simply let the plants alone without further inquiry.

Any one having a window-garden or conservatory not heated by hot air, or a greenhouse, need not hesitate to grow Orchids, especially the cool kinds. I find considerable satisfaction in growing about three dozen plants. They do not receive more special attention than other classes of plants in the same house, and they give a full share of flowers. During the winter there is usually a succession of bloom from even this small collection. As my greenhouse is at some distance from the dwelling, when the plants flower I enjoy them by the simple expedient of hanging them up in the living-room, the air of which does not seem to affect them nearly so much as it does soft-wooded plants. As to temperature, they take their chances with Begonias and similar plants, but I find that those do the best which hang under the glass near the ventilators, where they get plenty of fresh air. Here I have Cattleyas in variety, Lælias and Odontoglossums, the latter only when they are about to flower; at other times they are grown in a cool compartment. Many of the Cypripediums, as C. insigne, C. barbatum and C. Lawrencianum, as is well known, offer no difficulties in culture. Cœlogyne cristata is also an easily grown white-flowered Orchid, and one of the most satisfactory. Any one should be able to flower Lycaste Skinneri. Of the Cattleyas, C. Trianæ is the most common, and seemingly the most popular, though the type is of a most depressing red-purple. C. Mossiæ, C. Percivaliana and C. Dowiana are also easily managed. C. citrina, the curious yellow fragrant Cattleya, is not apt to be long-lived, but is worth growing. Another yellow-flowered Cattleya, C. chrysotoxa, of the usual family form, is beautiful, and a relief from the purples. Of the Odontoglossums, O. Alexandræ crispum is undoubtedly the handsomest. O. Rossi major is a very satisfactory species, white, with brown spots, easily managed, and very profuse in flower.

Any of these plants can be had, established in pots or baskets, at a moderate price, or at a higher price if select forms are wanted. Sometimes one can do better by buying unflowered plants, with a chance for something better than the average. When a plant-collector finds a lot of plants in flower he naturally marks the extra choice, which, of course, are held for high prices. The general collection will vary considerably, and it is reasonable that the dealer should not sell the best varieties, after testing, at the lowest price. Those who are making collections of Orchids usually buy largely of collected unflowered plants, especially if they think a collector has been in a good district, so that they may select good forms at a fair price, and then sell the discarded plants. This wholesale buying had, however, better be avoided by the amateur beginner, as it leads to business, which it is well to keep free from if pleasure is the object of growing Orchids.

Elizabeth, N. J. *J. N. Gerard.*

Fig. 18.—The Mangrove-tree (Rhizophora Mangle) in Florida.—See page 97.

Billbergia Bakeri as a House-plant.

IT is not easy to say why the Bromeliaceous order is not more favorably regarded by cultivators; for, though it contains many plants of a highly ornamental character, a large part of which require no more care than Geraniums and similar plants, and succeed in a temperature by no means high, we may

go through a score of greenhouses without finding one of this order, except, perhaps, a variegated Pine-apple. I have cultivated Billbergia Bakeri for the last twenty years with much satisfaction, it never having failed in that time to blossom at the proper season. At this time, February 15th, every new growth is sending up its thick clusters of buds, although on our coldest morning the water in the deep vases of its leaves was skimmed over with ice, showing a remarkable degree of hardiness in a Brazilian plant.

Billbergia Bakeri has a tufted habit of growth, the leaves, to the number of six or eight, springing up together from the surface of the soil and clasping each other at the base so closely as to form water-tight vases. These leaves are about twelve inches long and two broad, as stiff to the touch as parchment, dark green changing to dull red at their edges, and covered externally with a whitish dust. If kept in a warm house the flower-spike will show itself as early as the first of January at the bottom of the leaves, the buds wrapped in the rose-colored bracts, forming a mass as thick as a man's thumb.

When fully developed this plant is a very beautiful object, with its four or five large rosy bracts and its dense pendulous cluster of tubular blossoms, bright green with violet tips, and twisted orange anthers. The cultural requirements of the plant are simple. Like most of the order, it lives, apparently, on the moisture of the air and the water in its vases. It has no need of a pot except as a base to stand on. I have had as many as six spikes in bloom at once on a plant in a two-inch pot, and, of course, no repotting is necessary. Beyond giving an abundance of water, almost the only care needed is to cut off the old leaves when the flowers have faded and the new growth is about six inches high. *W. E. Endicott.*

Canton, Mass.

Roses.

THE month of February usually includes a number of dull days and much damp weather in this latitude. Great care in watering, ventilating and heating Rose-houses is therefore necessary, for while the rays of the sun are becoming stronger each day the changes are sudden and frequent. Light top-dressings of manure should be given from time to time. If the Roses are in a good growing condition such an application will be beneficial once in six weeks; not more of the fertilizer than a depth of one inch should be applied. The fertilizer most in favor among large Rose-growers is a mixture of horse and cow manure, short and well-rotted. Special fertilizers have been tried by some growers, and occasionally with good results. Nitrate of potash and nitrate of soda are among the most satisfactory, but I think in most instances they have been more effectual when combined with the soil than when given in surface applications. Bone-dust continues in favor and is an excellent and lasting plant-food, providing it is the natural bone, ground up, and not the mere fibre of the bone from which various oils have been extracted, this having very little value for indoor-gardening. This fertilizer may be used to advantage by mixing a moderate quantity in the compost in which the Roses are planted, and also as a top-dressing, though in the latter case it is well to mix the bone with some soil, or the fertilizer may be thinly spread over the surface of the bed and then covered with a very thin coating of stable-manure. Droppings from the hen-house make a quick and powerful fertilizer, but must be applied with caution, and are better mixed with some fine soil.

Methods and measures of heating still prove interesting topics among Rose-growers, and especially so at this season of the year, for the quality of the flowers produced largely depends on the care given to this particular. Among commercial growers steam-heating is quite general, from the fact that it is more easily regulated; but its economy as compared with a good system of hot-water heating has not been thoroughly proved; and, in fact, the weight of evidence, where comparative tests have been made, has been in favor of hot water on the score of economy. For small establishments and private growers the latter system is best, as a night man is not required.

The difference in temperature required by different varieties make a careful selection of varieties for forcing needful; it will readily be seen that, among Roses, Meteor, a variety that furnishes good flowers in a temperature of sixty to sixty-five degrees cannot be successfully grown in company with Papa Gontier, because the latter gives its finest blooms in a night temperature of fifty-three to fifty-five degrees; when grown in a warmer temperature it usually fails before the end of the winter. Madame de Watteville is another Rose of peculiar behavior when forced, and also seems to be most satisfactory in a comparatively high temperature and in rather light soil; Madame Cusin is of somewhat similar character, both these being admirable varieties when well grown, but having little beauty unless properly managed. Madame Testout has been receiving some adverse criticism as a commercial variety during this, its second season, the fault most noted being the comparatively weak stem on which the large flowers are produced; but as the requirements of this variety are better understood better results will probably be secured. Some other varieties now considered standard have passed through just such criticism in the first years of their introduction. Empress Augusta Victoria seems to be gaining in favor; the flowers are large, full and borne on stout stems well clothed with handsome foliage. The claim of the introducers seems to be warranted that this variety would prove a decided acquisition to the list of white, or nearly white, Roses.

Mr. Burton's new pink Rose, American Belle, is, in my estimation, superior to its parent, American Beauty, in one respect at least, that its color is clear and pleasing. American Beauty is seldom clear except when freshly cut, whereas flowers of the American Belle, kept in water for several days, continue in good color to the end. In habit of growth it would be almost impossible to distinguish American Belle from the parent variety, except that, at present, it appears slightly weaker; this may be due to overpropagation, and will probably be remedied by a few seasons of careful growing.

The latest Mermet sport placed upon the market, and now recognized under the name of Bridesmaid, is a handsome Rose; it is best described as a dark Catherine Mermet, the lovely form of the original flower being faithfully reproduced. This sport seems now to be much more promising than its predecessor on the same line, Waban, the latter having failed as a forcing variety in most places, though at times producing some very handsome flowers.

Holmesburg, Pa. *W. H. Taplin.*

Cultivated Palms in California.

NOTHING in the whole range of vegetation so impresses the traveler from less-favored climes than the presence of lofty Palms. At the residence of Mr. Kinton Stevens, of Montecito, Santa Barbara County, can be seen a pair of Cocos plumosa, less than eleven years old, over twenty feet high, with well-defined trunks. In the same gardens are thrifty specimens of Seaforthia elegans and Jubæa spectabilis, the Coquito, or little Cocoanut of Chili, the latter a very hardy Palm; there is also a good collection of fan-leaved Palms, including Sabal Palmetto, of Florida. At the residence of Mr. Sheffield, in Santa Barbara, is a fine Seaforthia, which has already produced fertile seeds.

In Los Angeles, at the home of Mr. E. Germain, flourishes a thrifty plant of Kentia Forsteriana. This plant has been in the open three winters and is a model of health and beauty. Few species can surpass Kentia Forsteriana; it ultimately attains a height of forty feet; it is indigenous in Lord Howes Island. At Mr. H. Jevne's place a smaller example of the same species seems well established. Near Rosedale cemetery, in a private garden, a good young specimen of Cocos plumosa occurs; this has been planted out for several seasons. Mr. Forester, on Seventh Street, and Mr. Declez, on Sand Street, also have good plants of Seaforthia elegans, out several years in the open ground; at Coronado Beach, beautiful plants of Areca Baueri, Kentia Forsteriana, Seaforthia elegans and Cocos plumosa can be seen. There yet remains a number of good Palms to be introduced to open-air cultivation, notably Kentia Belmoreana, K. Canterburyana, K. sapida, Areca Baueri, Cocos flexuosa, C. australis, C. coronata, C. Yatai and C. Romanzoffiana, Ceroxylon Andicola, Caryota urens and Ptychosperma Alexandriæ, all of varying degrees of hardiness. In some particularly sheltered and warm places along the foothills, it is not improbable that Oredoxa regia would flourish.

We know comparatively little of the Andean Palms of Bolivia, or the remoter alpine regions of Venezuela, while Paraguay is almost a botanical terra incognita. Count Castleman, during his great Brazilian expedition, records having seen many Palms on the confines of Paraguay; of only a few of these is anything known. Spruce, in his valuable essay on the Palms of the Amazons, alludes to several genera and species as occurring at considerable altitudes. Iriartea ventricosa and I. exorhiza ascend the Andes to 5,000 feet. According to Humboldt, Ceroxylon Andicola, the famous Wax Palm of Columbia, was found growing in the Cordilleras, near the pass of Quindiu, between Ibague and Cartago, at from 7,900 to 10,000 feet, in company with Podocarpus-trees and Quercus Granatensis, not very far from the snow-line. From the temperate mountain regions of subtropical Mexico are known, among others,

Chamædorea concolor and Copernicia Pumos, the latter a fan-leaved Palm, at elevations of from 7,000 to 8,000 feet. In my garden, Chamædorea desmoncoides seems quite hardy. Some of the Mexican Acrocomias and Astrocaryums, splendid spinescent Palms, would undoubtedly flourish in favorable places here. In Ceylon, Oncosperma fasciculatum, a slender-stemmed prickly Palm, of great elegance, occurs as high as 5,000 feet, while Copernicia cerifera, the Brazilian Wax Palm, extends into Argentina, and would likely flourish here.

It should not be inferred that the fan-leaved section of Palms is much less beautiful in all species than those of the former group. Indeed, a few species rival and some excel the pinnate Palms in magnificence, and no paper would be in any degree complete without reference to them. Commencing with Washingtonia filifera, which is abundantly represented, we have, in lesser numbers, Chamærops excelsa and C. humilis, picturesque, but stiff and ungraceful Palms. Not quite so common is Corypha australis, a fine Australian Palm. Still rarer is Latania Borbonica, a fine fruiting specimen of which can be seen at Mr. Hancock Johnson's place in East Los Angeles. There are two other fine Palms, rarely seen, and yet their native habitat is less than 400 miles distant—Erythea edulis, from Guadaloupe Island, off the coast of Lower California, and E. armata, occurring in deep canyons just below the state line in Lower California. They are both quite hardy and make splendid plants as they attain size. The former has rich, dark green leaves, much darker than Washingtonia, and without the filaments so characteristic of this species, while the foliage of E. armata is an ashy blue, and one of the most distinct of Palms.

The Sabals, of which S. Palmetto, of Florida and other southern states, is so well-known, are rarely seen in our gardens here. All are sufficiently hardy. All of the species of Thrinax are elegant plants.—*J. C. Harvey, in Rural Californian.*

Correspondence.

Feeding-places for Birds.

To the Editor of GARDEN AND FOREST:

Sir,—The destruction of birds through the severe cold and the snowing under of seed-bearing weeds and other food-supplies, will in some sections of the country be complete. Cedar-trees provide excellent shelter for quail and grouse, and their berries, which last season were very abundant, afford them food. Years ago an occasional stack of grain was left in the fields for the birds, giving them at once food and protection from the cold. There are yet some farmers imbued with the spirit of Walter von der Vogelweid, who

> Gave the monks his treasure,
> Gave them all with this behest,
> They should feed the birds at noontide
> Daily on his place of rest.

One of my neighbors daily throws a few handfuls of grain on a stack of corn-stalks near his barn, to the delight of a large number of birds, who are regular visitors. Game societies should see that food is distributed where birds abound, in places that will not be covered by snow and ice. Many of our quail are the offspring of southern birds, and their instincts do not prepare them in the first generation to battle with our climate or to search for food. I observed recently a bevy of nine birds frozen to death, within half mile of a sheltered swamp, to which our native birds would have gone.

Plainfield, N. J. *Percy C. Ohl.*

New Hybrid Cypripediums.

To the Editor of GARDEN AND FOREST:

Sir,—The following new hybrids have recently flowered in Mr. H. Graves' collection at Orange, New Jersey:

Cypripedium × Tacita, Measuresianum × Tonsum. The foliage of this new hybrid is very striking. The leaves are five to eight inches long and one and a half inches wide, dark green, with darker reticulation above, the reverse suffused with vinous purple, particularly the midrib and base; flower-scape slender, pubescent and monoflorous; seed-pod pale, covered with purplish pubescence; flower waxy, large, five inches across, ground color sepia-green, shaded with vinous brown; the dorsal sepal is veined with brown and margined with white; petals rounded, tapering toward the base, a median line of brown extending their full length; the upper half is slightly the darker, on which the customary hairs are wanting; lip rather acute, with long outer lobes, which are barbate; the infolded lobes are slightly spotted with brown; staminode obcordate.

Cypripedium × Hebe. This variety was obtained by crossing C. Spicerianum with C. Stonei. The general appearance of both plant and flower is like C. Spicerianum, but the foliage is more pointed and stiff, and the flower more graceful. The flower-scape is erect, slightly pubescent, about ten inches long, and bears one flower; the dorsal sepal is much reflexed, hirsute, and white, with a purple midrib and green base; petals two inches long, pointed, wavy and hirsute at base, primrose-yellow, shaded with brown, divided by a brown midvein from apex to base; lip apple-green, tinted with brown on front; the infolded lobes lavender; staminode octagonal, lavender-purple, with a yellow disk.

Orange, N. J. *Robert M. Grey.*

Salix balsamifera.

To the Editor of GARDEN AND FOREST:

Sir,—A few further notes regarding the distribution of Salix balsamifera in New England may be of interest to those who have read the account of this species on pages 28 and 82 of the present volume of GARDEN AND FOREST.

Since the article by Mr. Bebb, in the *Bulletin of the Torrey Botanical Club* was written, it has been found that this handsome Willow extends over northern New England. Although somewhat local in distribution, this species may be confidently looked for in more or less abundance anywhere north of the latitude of the White Mountains, and it may appear frequently somewhat south of this line. In some localities it is far from being an uncommon plant, and in others it appears only here and there over a great extent of territory. It certainly is extraordinary that such a well-marked and distinctly beautiful species should have been so long confused with S. cordata, and perhaps with S. discolor, some forms of which it slightly resembles. To the description of the species it seems proper to add, that under favorable conditions the height of this shrub may be much greater than ten feet. In a swamp at Franconia, New Hampshire, it has been discovered by Mr. Charles E. Faxon, fully eighteen feet in height. Such plants, however, are rare.

About twelve years ago specimens of this Willow were collected at Fort Kent, Aroostook County, and at Patten, Penobscot County, Maine, by Miss Kate Furbish. They were laid aside and their identity unsuspected until last year. In 1888, a number of new stations were discovered in Maine, and the plant was identified beyond question. These stations were: Orono (M. L. Fernald), Mount Desert (Rand), and Greenville (Edwin Faxon). At the first-named station only one small plant was found, which has since been destroyed. At the last-named station a great number of plants were observed. In Mr. Faxon's opinion this Willow is probably common in all the region south of Moosehead Lake. A year later, in 1889, I discovered one plant at Andover, Oxford County, nearer the New Hampshire line.

Thus far, Mount Desert Island seems to be the only coast station within the limits of the United States where the presence of this interesting Willow has been reported. It may be well, therefore, to say a few words in regard to its distribution and growth under such geographical conditions. As seen at Mount Desert its height varies from two to six or eight feet. Its range of distribution is from the sea-level to mountain-bogs, about one thousand feet in altitude. Although the mountain forms are smaller-leaved and more stunted in habit, they cannot be regarded as anything but typical in form. The most marked peculiarity of its distribution lies in its local character, and in the fact that in very many of the fifteen or more stations here known, the plant is represented by only a single specimen, with no other plant of the same species apparently occurring in the neighborhood. During the last four years Mr. John H. Redfield, Mr. Edwin Faxon and myself have made close search for this Willow on the island, but we have nowhere been able to find it in very great abundance. It is not, therefore, a plant that at Mount Desert would be likely to make much impression on any but a sharp-eyed observer, in spite of the great beauty of its male flowers and of its foliage. It would be well if this striking Willow could be more used for planting at Bar Harbor and elsewhere in place of shrubs that are little in keeping with the character of the scenery, and that can thrive only under artificial conditions.

In this connection another interesting Willow of Mount Desert may be mentioned, Salix petiolaris, Smith, var. angustifolia, Anders., D C. *Prod.* xvi., pt. ii., 234 (S. rosmarinifolia, Barratt, Hooker and others). "It is a northern form of the species, undistinguishable at the west from var. gracilis, Anders., into which it passes, but is here worthy of varietal recognition,"

says Mr. Bebb. As it is found at Mount Desert it grows in meadow copses to a height of eight to ten feet or more. The leaves are small, seldom more than one inch in length, very narrow, dull in color, usually with more or less rusty pubescence on the under surface. The foliage is very thick, almost gray in color effect. The shrub is often very compact and well shaped. It is common on the island under suitable conditions, and would make an excellent shrub for planting in low ground. Away from Mount Desert I have not yet observed it. Mr. Bebb states that it had not been called to his attention when the sixth edition of *Gray's Manual* was published as occurring within the geographical limits of that work.

Boston, Mass. *Edward L. Rand.*

The Season in Northern California.

To the Editor of Garden and Forest:

Sir,—The vegetation in this part of California is but little more advanced now in the second week of February than it was in December. Throughout January the nights were frosty, the days being bright, except that the month ended in a heavy storm, cold weather and a flurry of snow. The lowest temperature of this season was twenty-four degrees below zero. There have been few flowers, and I have observed in blossom only Irish Anemones, Crocuses and Narcissi. Lauristinus is blooming, and so also is the Japanese Quince. Acacia molissima, very common here as a shade-tree, begins to show color, and among the wild trees the Manzanita and California Laurel are beginning to grow.

The open winter has been favorable for starting new orchards. Throughout the state the number of fruit-trees planted has been very large. December and January are the favorite months for putting out deciduous trees. More Peach and Prune-trees are being planted this season than any other kind of fruit-trees. Favorable prices for products last season have greatly stimulated the fruit industry.

In a January issue of Garden and Forest I called attention to some inequalities of climate here in places not far apart. An incident of last week serves well to emphasize the point. Cloverdale, a neighboring town, situated on the same stream, at an altitude differing but a hundred feet or so, and only thirty miles distant from us, has been holding a citrus fair. The town-hall was well filled with fine oranges grown without the least protection in the yards and orchards of the burgh. In a few years the Orange-groves now planted there will yield several car-loads of fruit.

It was with much interest that I read Mr. Horsford's article in Garden and Forest of February 1st, on "Some American Bulbs." The rainy season in Mexico comes at the same time as the dry season in California. Hence Mexican bulbs are naturally dormant during your winter and start into growth in spring. In California, bulbs, such as Calochortus and Brodiæa, ripen up soon after the cessation of the winter rains, that is, in May and June in northern California, and a little earlier in southern California. The dry summer is their season of rest, and with the first fall rains they commence active growth, which is continued during winter. All Californian bulbs should be planted in the fall, and it is my experience that they can scarcely be kept from growing in winter, even when dry, in the house. I notice that cultivated bulbs can be kept dormant longer than wild bulbs, but it is likely that these will gradually change their habit in cultivation. I note that bulbs of Camassia esculenta, from Holland, are quite dormant now, showing no sign of growth, while collected bulbs kept dry have long sprouts. In Oregon, bulbs are much later in ripening than in California, and it is possible that some sorts can be kept dormant during the winter and planted in the east in the spring. The seasons in Arizona are more like those in Mexico, and it is not unlikely that some bulbs from that state will be valuable for spring planting. The dwindling away of Calochortus-bulbs after the first season, of which Mr. Horsford complains, is not a result of the eastern climate. My earlier experience here was the same. Bulbs blossomed, but at the expense of the bulb. Some rare sorts still serve me in this way until I learn how to treat them, but I find now that with most sorts I get fine bloom and a well-developed bulb. Too much moisture, too deep planting or a stimulating soil will cause a decrease in the size of the bulbs. I have no doubt that several Calochorti will grow successfully in the open in the eastern states. In the cold frame in pans they can be grown splendidly there.

Mr. E. O. Orpet, in writing of Lilies a short time ago, referred to the habit of some Californian varieties remaining dormant for a season. I am satisfied that L. Washingtonianum frequently does so in its native home. I have often dug sound bulbs at the end of a season which had made no growth, and have heard the question asked why in places where the plants are rare one year, many are to be found the next season. None of the rhizomatous Lilies have this habit, and I do not think L. Humboldtii as markedly so as L. Washingtonianum.

Ukiah, Calif. *Carl Purdy.*

The Forest.

The White Mountain Forests.

THERE is not anywhere else in the United States such an opportunity for co-operation as is now offered by the entire condition of things in the White Mountain region of northern New Hampshire.

The three great interests there—the three kinds of property—are, very curiously, not merely situated very close to each other, but they occupy absolutely the same ground. The area of the beautiful scenery which attracts the summer tourists, who bring millions of dollars to the state every year, is the land that produces the timber that is worth other millions of dollars. Then the same land, the same area of mountain-forest, that grows the timber and is clothed upon with the beautiful scenery, is also the great sponge that stores and holds the water that feeds the summer flow of the Androscoggin and the Connecticut, the Merrimack and the Saco. The great towns and their beneficent industries at the falls of all these rivers depend on the preservation of the spongy forest-floor which holds and distributes the water which falls on the whole region. Whatever impairs the permanence of forest-conditions on any considerable area injures both the scenery and the water-supply.

The question of the proper adjustment of these different interests, and of their relations to each other, is one of the most important problems ever presented to our people by the changing conditions of life in our country. The fact that these different interests and investments belong to different owners, and that the entire region is private property, renders the problem peculiarly delicate and difficult. But there is really no necessity that the slightest wrong or injustice should be done to anybody.

The people who receive the money from the sale of the timber-products of the region are not the same people who receive the other millions of dollars from the commercial value of the scenery. Then the millions of capital produced and banked up by the power of the falling water, in the cities far down the rivers toward the sea, constitute the very means of existence, and the basis of the home-life and civilization, of multitudes of men and women who never saw the mountain-forests which sustain the streams, the mills and the homes.

There is no antagonism between these several interests if they are regarded and managed with intelligent recognition of facts and essential conditions; they harmonize perfectly with each other, and what is best for either of them is the very best thing possible for both the others. Why should not the men who represent and control these different interests and resources recognize the value of each other's property, and co-operate with each other, in business-like and practical ways, for the conservation of all these great possessions? I think that enlightened self-interest is a pretty good principle or rule of conduct; but, unfortunately, self-interest is not always enlightened. Sometimes it does not look far enough ahead to have a right understanding of the present time.

The matter is important enough to require and reward the careful attention of the foremost people of the civilized world, the people of New England.—*J. B. Harrison, in the Boston Commonwealth.*

The White Pine for Timber.

REFERRING to the correspondence printed on page 609 of the last volume of Garden and Forest, with regard to the White Pine (Pinus Strobus), I can agree with the writer that it is one of the most valuable trees, not only in Massachusetts, but in a greater part of the eastern states than is generally believed. It thrives and grows rapidly on land too sandy to produce any kind of farm crops profitably, although it grows more rapidly on richer land. I have heard of immense White Pines on poor land in Virginia, and have been surprised at finding such remarkably fine specimens, and in such quantities, in the forests of western North Carolina and eastern Tennessee.

The writer of the paper printed in Garden and Forest deserves much credit for the pains he has taken in examining into the subject. He is mistaken, however, in thinking that because the seeds ripen in September they should be sown

in the autumn. The White Pine is no exception to the rule that all the cone-bearing trees in the northern states, with the exception perhaps of one or two kinds of little or no commercial value, ripen their seeds in the autumn; and the seeds of all are scattered in nearly the same manner. The cones hang on the trees until the seeds are distributed by means of the winds. A plantation made with the seeds planted two together, with spaces four or five feet apart, would be an absolute failure. It is doubtful if twenty seedlings to the acre would be produced by this method. No White Pine-seed could germinate if it was covered with half an inch of soil, and half an inch is a doubtful measurement when left to the judgment of the ordinary planter. I speak thus positively because I speak from experience. There are 20,000 White Pine-seeds in a pound, and on the very best land in the best possible condition, and sown by the most experienced workmen, and protected from birds, I do not believe that it would be possible for any one to raise 10,000 seedlings from 20,000 seeds. 5,000 would be a good stent, and 7,000 much above the average.

White Pine-seeds, when gathered, should be put in paper bags and laid away in a box or drawer until spring. A few years ago I imported from Germany several hundredweight of the seeds of this tree that had been exported from the United States in the autumn of the previous year; they reached Waukegan before the opening of spring, and the person for whom they were intended, not being able to plant them, they were left on our hands. The following spring, that is eighteen months after the seeds were gathered, we sowed fifty pounds of it and it germinated perfectly. Rather than to plant seeds it would be better, of course, to take young trees from open places in the forests, where they can be found in quantity, but it would be expensive to dig them with balls of earth, and they are rarely found growing in the sort of soil which adheres to the roots. The method of covering the roots with puddle would be a much better and cheaper method.

The White Pine grows rapidly after the first few years, although, on account of the delicacy of its foliage, it is uncertain for the first two or three years, especially the first year, as it is subject to damp off in rainy or cloudy weather and to burn off in sunshine. However, in the moist climate of Massachusetts, young plants might not suffer as much as they do with us in Illinois, and the experiment would not be a very expensive one; but instead of two seeds to every twenty-five square feet, as recommended by your correspondent, I would advise the sowing of at least two pounds of seed to the acre, and a larger amount even would be better.

As to hiring men to prune forest-trees from the time they are eight feet high until they are of a size and age to make clear lumber, my opinion is that it cannot be done with profit to the planter. Fortunately this is not necessary. No better or clearer lumber will ever be grown than the Michigan pineries produced naturally forty years ago. "Plant thick and thin quick," is as good advice to-day as it was a hundred years ago.

Larkspur, Cal. *Robert Douglas.*

Exhibitions.

Carnations at Philadelphia.

THE feature of the monthly meeting of the Pennsylvania Horticultural Society, held on the 21st of February in Horticultural Hall, Philadelphia, was a display of Carnations. The flowers were above the average in quality, some of the varieties being particularly well grown.

In A. M. Herr's exhibit the committee commended Grace Darling, Daybreak, Aurora, Fred. Dorner, Annie Webb and Louisa Porsch; a vase of Golden Triumph won high praise from the committee, and received general admiration. Among choice flowers shown by Edward Swayne, Mrs. Fisher, Daybreak and Lizzie McGowan were singled out for commendation, and Aurora, Puritan and Thomas Cartledge received favorable mention.

Mr. Craig had a fine vase of the beautiful Edna Craig; J. R. Freeman and Puritan were also good. In a vase of seedlings shown by G. F. Christie, Clifton Heights, a white and pink were selected by the committee as promising. If these Carnations continue as good after further testing they will certainly hold a place among the best new varieties of the year. A vase of Pearl in this collection was good, and Lizzie McGowan and Hinze's White were also worthy of note.

Herman Brushaber showed a fine specimen of the white Cyclamen, a well-grown plant of fine habit and medium large flowers.

Arrangements were perfected at this meeting for the spring exhibition to be held in March. The decorations will, as usual, be under the management of Mr. Wescott.

The Flower Show at Rose Hill Nurseries.

THE seventh annual exhibition of Messrs. Siebrecht & Wadley is now in progress at Rose Hill Nurseries, New Rochelle, New York, having begun February 22d, to continue to March 4th. The firm will take part in the exhibition of the New York Florists' Club, to be held in Madison Square Garden in May, and the change from the usual exhibit in this city has therefore been made.

Plants in greenhouses in various stages of development naturally make a less imposing display than selected plants in a hall arranged with a special view to effect, but a visit to the nurseries is highly interesting and instructive. The grounds comprise thirty acres, and there are fifty-two greenhouses. As is well known, this firm are extensive growers of Orchids, Roses and fine ornamental plants. Five houses are devoted to Ferns alone, and twice as many to Roses. In one of the Palm-houses specimens of Caryota urens, Dicksonia antarctica and Ptychosperma Alexandræ reached the roof, eighteen feet above. Pyramids and standards of the Bay-tree (Laurus nobilis) filled one house, and in another Lilacs were in luxuriant bloom. In a large collection of Dracænas were many unnamed seedlings which promise some good distinct varieties. Woody canes of the Dracæna, grown for this purpose in the nurseries of the firm at Trinidad, are layered for propagation in a forcing-house. Lilies-of-the-valley, in flower and in various stages of growth, filled several houses. One hundred and sixty thousand pips are used here during the season. Besides a house of Jacqueminot Roses, Azaleas, Hydrangeas, Lilies and Cytisus are being brought on for Easter.

The variegated Begonia B. metallica aurea attracted attention, and the bronze purple foliage and dark green veining of B. Arthur Malet made these plants conspicuous in this class. A new seedling Amaryllis from Trinidad, Mrs. James W. Waterbury, showed a compact habit with clusters of from five to seven flowers. Many of the Rose and Orchid houses indicated the extensive trade done in cut flowers, only buds showing among the leaves. The main exhibition house is 137 feet long and is bright with color. Numerous plants of Odontoglossum crispum Alexandræ show this favorite in varying forms. Dendrobium crassinode Barberianum is a noteworthy variety with orange throat and white petals tipped with purple; the colors are brighter, darker and more distinct than in the type. D. nobile elegans is a pleasing new variety of rich coloring darker than the type throughout. Epidendrum bicornutum is especially delicate and pleasing, resembling Phalænopsis amabilis, but is smaller. Dendrochilum glumacea, with fragrant racemes on spikes over a foot long, Cattleya trianæ alba, Cœlogyne cristata and Lælia albida bella were also shown in this house. A collection of Orchids suggested for window-culture included Lælia anceps, Cypripedium insigne and varieties, C. barbatum, C. venustum, Epidendrum vitellianum, Cœlogyne cristata and Lycaste Skinneri. A distinct department is the flowering of Orchids for the summer season at Newport, where there is a branch establishment.

Anthurium Chelsoni, a dark form of A. Andrianum, made a favorable impression. A. Schertzerianum Wardi showed a more erect stem and a longer and finer form than the type. The spathe of a flower grown in a six-inch pot measured three and three-quarter inches across and five inches long. A. Rothschildianum was also represented. An idea of the business done in furnishing private greenhouses and conservatories was given by a large house filled with several hundred decorative foliage-plants just returned to the nurseries for treatment.

Recent Publications.

Onions for Profit. By T. Greiner. Published by W. Atlee Burpee & Co., Philadelphia.

This little book attempts to set forth in a clear way what is known as the "New Onion Culture," a method which is based on the fact that Onion-seedlings endure transplanting better than most vegetables. The crops can, therefore, be started under glass several weeks before the seed can be sown out-of-doors, so that the crop matures much earlier. The size of the bulbs under this treatment can be increased as well as the yield per acre. The cultivation is made much easier and the task of weeding is reduced to a minimum, since the ground can be made clean before the plants are set out, and when the weeds

do appear they will not be larger than the Onions, as they usually are when the seed is sown early in the spring. Of course, there is nothing absolutely new in this idea, but the application of it to Onions is comparatively recent. Mr. Greiner goes carefully into the details from the very beginning and talks instructively about the various kinds of fertilizers, the proper tools for the preparation of the soil, the methods of sowing the seed and setting the plants, and all the other details to the curing and preserving of the tubers. The book is primarily for market-growers, but its clear statement, coming from practical and thorough knowledge of the subject, makes it entertaining and instructive to every one who has a vegetable-garden.

Notes.

Mr. Charles Eliot has become a member of the firm of F. L. Olmsted & Company, landscape-architects, of Brookline, Massachusetts.

A photograph of a Hop-field, taken at Tacoma, represents the poles at least fifteen feet high and so densely covered that they appear like solid pillars of foliage more than two feet in diameter.

Mr. Dewar, an occasional correspondent of this journal, and for many years the head of the Hardy Plant Department of the Royal Gardens at Kew, has been appointed curator of the Botanic Garden at Glasgow.

Rhododendron arboreum, an Indian species, not hardy here, is an excellent greenhouse plant. Kept in buildings in which only enough heat is given to keep out frost, it expands its heads of rich rose-colored flowers in February.

In a greenhouse in Germantown, Philadelphia, is a specimen of the Cactus, Cereus Peruvianus, planted fifteen years ago, which reaches to the roof, twenty-five feet from the ground. Its large yellow flowers are produced toward the close of June.

At a meeting of the finance committee of the incorporators of the Botanic Garden of New York City, held last week, Mr. J. Pierpont Morgan reported that $175,000 has been procured of $250,000, the cost of 250 acres of land in Bronx Park, which it is desired to secure for the exclusive use of the Botanic Garden. Mr. Morgan proposes, in addition to $250,000 required by legislative act to establish the Garden, to increase the fund to $1,000,000.

Correa cardinalis is perhaps the most beautiful shrub of this genus which comes from the southern part of Australia, where it is often called Fuchsia, from a fancied resemblance between the blossoms of the two plants. This is by no means a new plant in gardens, but it is seen more rarely in American greenhouses than it should be. The flowers are handsome and they are borne in great profusion at this season, when just such bright colors as their red and yellow are needed. Correa cardinalis is one of the special attractions of the rich outdoor-gardens of southern Europe.

The spring exhibition of the New York Florists' Club will be held in the Madison Square Garden during the first week in May. But, meanwhile, smaller free exhibitions have been planned for at the headquarters of the club at 20 West Twenty-seventh Street, the first to be held early in March. Admittance will be by tickets, which can be obtained from the secretary of the club, Mr. John Young, or from any florist who is a member. Many growers have promised interesting contributions for these small displays, and it is expected that prizes will be awarded to the best exhibits.

The large and beautiful Montreuil peaches, known to all visitors to Paris, are said to date from the reign of Louis Quatorze, and to have been first planted by an officer of musketeers named Girardot. The king's approval of an offering of these peaches gave an impulse to peach-growing, and a century later, not only Montreuil, but a whole circle of neighboring villages, possessed many Peach-gardens. Some of these villages have been absorbed by the city of Paris, but the remaining villages supply, during the season of two months and a half, about twenty-five million peaches, or some three hundred thousand each day. The finest specimens are often sold in restaurants at sixty cents apiece. They are grown on espaliers trained against sunny walls.

Signor A. Goiran, who has investigated the influence of recent earthquakes in northern Italy, thinks that they were beneficial to vegetation as promoting a more rapid germination of seeds, a quicker rate of growth in the young plants, a distincter greenness in all vegetation, and a greater luxuriance in pastures, arable lands, copses and vineyards. These results he lays to an increased production of carbonic acid, an augmented development of electricity, and a completer distribution of fertilizing matters through the shaken soil. If, in certain cases, vegetation seemed to have suffered after an earthquake, Signor Goiran attributes the fact to the prolonged droughts which accompanied them.

In an article recently published in the *Popular Science Monthly* it is stated that, inasmuch as the food of the garter-snake consists largely of frogs and toads, it is probably harmful to vegetation. The argument to establish this theory runs as follows: "The greatest enemies of the leaves are the insects; frogs and toads depend upon insects for their food, and snakes, in their turn, feed upon frogs and toads. So that the more snakes the more insects, and the fewer perfect leaves." Such generalizations, however, are dangerous, for although the snakes will eat frogs and toads as well as anything else in the line of small animals that they can master, they also eat a great many insects, and they could not, under any circumstances, in justice, be called protectors of insects.

Dr. J. T. Rothrock is now to devote his whole time to the interests of the Pennsylvania Forestry Association, as its general secretary, and those objects which the Association was formed to foster are to be pressed with vigor. He will deliver illustrated lectures in various parts of the state and incidentally contribute an illustrated article to each number of *Forest Leaves*, the organ of the Association, that in the February issue being devoted to an account of the Buttonwood (Platanus occidentalis), with a portrait of a remarkable specimen growing in Chester County, Pennsylvania, with a short trunk divided, not far above the surface of the ground, into three enormous primary divisions. In speaking of the value of the wood of the Buttonwood, Dr. Rothrock overlooks the fact that in recent years it has been used in considerable quantities in our northern cities in the interior finish of houses. It is well suited for this purpose and its popularity is increasing. It is used in the natural color or stained to the color of mahogany.

In the United States Buckleya, of which a figure was published in an earlier issue of this journal (vol. iii., p. 237), is one of the rarest of all our shrubs, being found only on one small rocky cliff near the boundary line between North Carolina and Tennessee. In Japan, however, where the genus is represented by a species very similar to its American prototype, Buckleya, although not very abundant, is rather widely distributed through the interior of the main island between 2,000 and 3,000 feet above the sea, where it grows in the neighborhood of streams and forms a tall graceful shrub. Indeed, it is so common in some parts of the country that the fruit, which is gathered when about two-thirds grown, having been subjected to some pickling or preserving process, is sold as a condiment, packed in small, neat wooden boxes. Nikko is the headquarters of the industry, and in late autumn the fruit of Buckleya is displayed in many of the shops which line the street leading through the straggling village up to the burial-place of the founder of the dynasty of the Tokugawa Shoguns. To appreciate the flavor of Buckleya, the culture and refinement of the Japanese palate is essential.

In the autumn of 1891 the Chrysanthemums at the Geneva Experiment Station were troubled with a leaf-spot, which was pronounced by Dr. Halsted identical with the fungus referred to in an article of his entitled "Fungous Troubles in the Cutting-beds," and published in Garden and Forest (vol. v., p. 91). During the last year investigation has been made at the station of the work of this fungus, which belongs to the genus Septoria, and it has been found that the disease can be practically controlled even if infected plants are used for cuttings. The removal of spotted leaves, however, is a reasonable precaution, and since such foliage is full of disease germs it is always best to burn it. The remaining foliage is sprayed through a Vermorel nozzle with Bordeaux mixture five or six times during the season. If soap is dissolved in the mixture it causes a thin film to spread over the entire leaf-surface. The fungicide applied in this way adheres so well to the foliage that it is not necessary to make another application until there is sufficient new growth unprotected to require another treatment. Since the Bordeaux mixture is quite noticeable on the foliage, an ammoniacal solution of copper carbonate is almost as effective, and it can be substituted for the last application before the plants come into flower. This solution is made of five ounces of copper carbonate dissolved in three pints of ammonia, twenty-six degrees, and diluted to fifty gallons with water, enough soap being added to form suds.